

International Preliminary  
Examination Report (IPER)  
Amendments

WRITTEN AMENDMENT

(Amendment under the provision of

Section 11 of the Law)

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1. Indication of International Application :

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4. Objects of Amendment

Specification and Claims

5. Contents of Amendments

(1) In line 11, page 2 of the specification, "a backup ring - - - the slidable surface of the main lip" shall be amended to read as "an auxiliary lip integrally formed in an outer peripheral side thereof; a backup ring -

- - - the slidable surface of the main lip".

(2) In line 15, page 2 of the specification, "the outer peripheral member" shall be amended to read as "the outer peripheral member, wherein the auxiliary lip is brought into close contact with an inner peripheral surface of an inner peripheral step portion formed in an inner periphery of a contact portion with the washer in a rod guide fixed to the outer peripheral member and having an inner peripheral surface closely faced to an outer peripheral surface of the shaft so as to be continuous in a circumferential direction, with a proper fastening margin".

(3) In lines 18 to 19, page 2 of the specification, "formed in a sealed space side in an inner peripheral portion of the water" shall be amended to read as "formed in a sealed space side in an inner peripheral portion of the washer so as to be continuous in a circumferential direction".

(4) In line 27, page 2 of the specification, "fitted to a sealed space side of the washer" shall be amended to read as "arranged in a sealed space side of the washer in a state of being brought into contact with a rod guide fixed to the outer peripheral member and having an inner peripheral surface closely faced to an outer peripheral surface of the shaft, and having an outer

peripheral portion pressure-inserted and fitted to the washer".

(5) In line 15, page 7 of the specification, "the atmosphere A side" shall be amended to read as "the atmosphere B side".

(6) In lines 15 to 16, page 9 of the specification, "the atmosphere A side" shall be amended to read as "the atmosphere B side".

(7) In lines 5 to 6, page 12 of the specification, "the atmosphere A side" shall be amended to read as "the atmosphere B side".

(8) In lines 3 to 4 of claim 1, page 13, "a backup ring (44) - - - - the slidable surface (42c) of the main lip (42)" shall be amended to read as "an auxiliary lip (43) integrally formed in an outer peripheral side thereof; a backup ring (44) - - - - the slidable surface (42C) of said main lip (42)".

(9) In line 8 of claim 1, page 13, "said outer peripheral member (2)" shall be amended to read as "said outer peripheral member (2), wherein said auxiliary lip (43) is brought into close contact with an inner peripheral surface of an inner peripheral step portion (31) formed in an inner periphery of a contact portion with said washer (41) in a rod guide (3) fixed to said outer peripheral member (2) and having an inner

peripheral surface closely faced to an outer peripheral surface of said shaft (1) so as to be continuous in a circumferential direction, with a proper fastening margin".

(10) In lines 2 to 3 of claim 2, page 13, "formed in a sealed space (A) side in an inner peripheral portion (41a) of the water(41)" shall be amended to read as "formed in a sealed space (A) side in an inner peripheral portion (41a) of the washer (41) so as to be continuous in a circumferential direction".

(11) In lines 2 to 3 of claim 3, page 13, "arranged and fitted to a sealed space (A) side of the washer (41)" shall be amended to read as "arranged in a sealed space (A) side of said washer (41) in a state of being brought into contact with a rod guide (3) fixed to said outer peripheral member (2) and having an inner peripheral surface closely faced to an outer peripheral surface of said shaft (1), and having an outer peripheral portion pressure-inserted and fitted to the washer".

#### 6. List of Attached Documents

Pages 2, 2/1, 7, 9 and 12 of the specification, and pages 13 and 13/1 of the claims

and a troublesomeness is caused in an assembling work.

### Disclosure of the Invention

#### Problem to be Solved by the Invention

The present invention is made by taking the points mentioned above into consideration, and a technical problem of the present invention is to provide a sealing device for a reciprocating shaft, which has a sufficient pressure tightness of a main lip and does not cause troublesomeness of an assembling work.

#### Means for Solving the Problem

As a means for effectively solving the technical problem mentioned above, in accordance with a first aspect of the present invention, there is provided a sealing device for a reciprocating shaft, the sealing device being interposed between a shaft reciprocating in an axial direction and an outer peripheral member surrounding an outer periphery thereof, comprising

a washer;

a main lip integrally bonded to a sealed space side of the washer and slidably brought into close contact with an outer peripheral surface of the shaft;

an auxiliary lip integrally formed in an outer peripheral side thereof; a backup ring fitted to a portion between an atmosphere side of the slidable surface of the main lip and an inner peripheral portion

of the washer and bearing the main lip from the atmosphere side and the inner peripheral side;

a dust lip integrally bonded to the atmosphere side of the washer and slidably brought into close contact with the outer peripheral surface of the shaft; and

an outer peripheral lip integrally bonded to the outer peripheral portion of the washer and brought into close contact with the outer peripheral member,

wherein the auxiliary lip is brought into close contact with an inner peripheral surface of an inner peripheral step portion formed in an inner periphery of a contact portion with the washer in a rod guide fixed to the outer peripheral member and having an inner peripheral surface closely faced to an outer peripheral surface of the shaft so as to be continuous in a circumferential direction, with a proper fastening margin.

As another means for effectively solving the technical problem mentioned above, in accordance with a second aspect of the present invention, there is provided a sealing device for a reciprocating shaft, the sealing device being interposed between a shaft reciprocating in an axial direction and an outer peripheral member surrounding an outer periphery

thereof, comprising

a washer;

a main lip closely fitted to an inner peripheral surface of a main lip holding concave portion formed in a sealed space side in an inner peripheral portion of the washer so as to be continuous in a circumferential direction and slidably brought into close contact with an outer peripheral surface of the shaft;

a backup ring fitted to a portion between an atmosphere side of the slidable surface of the main lip and a rising surface of the main lip holding concave portion and bearing the main lip from the atmosphere side and the inner peripheral side;

a dust lip integrally bonded to the atmosphere side of the washer and slidably brought into close contact with the outer peripheral surface of the shaft; and

an outer peripheral lip integrally bonded to the outer peripheral portion of the washer and brought into close contact with the outer peripheral member.

As another means for effectively solving the technical problem mentioned above, in accordance with a third aspect of the present invention, there is provided a sealing device for a reciprocating shaft, the sealing device being interposed between a shaft



reciprocating in an axial direction and an outer peripheral member surrounding an outer periphery thereof, comprising

a washer;

an auxiliary washer arranged in a sealed space side of the washer in a state of being brought into contact with a rod guide fixed to the outer peripheral member and having an inner peripheral surface closely faced to an outer peripheral surface of the shaft, and having an outer peripheral portion pressure-inserted and fitted to the washer;

a main lip integrally bonded to a sealed space side in an inner peripheral portion of the auxiliary washer and slidably brought into close contact with an outer peripheral surface of the shaft;

- - - - integrally bonded to a sealed space side in the inner peripheral portion of the auxiliary washer

- - - -

since the backup ring 44 has a cut portion (a bias cut) 44a at one position in the circumferential direction, the backup ring 44 can be easily fitted to the portion between the supported surface 42e and the inner peripheral portion 41a of the washer 41, by being deflected in a contracted direction.

In the sealing device 4 in accordance with the first embodiment structured as mentioned above, the main lip 42 is slidably brought into close contact with the outer peripheral surface 1a of the rod 1, thereby preventing an internal sealed oil in the sealed space A from leaking to the atmosphere B side through the outer periphery of the rod 1. The auxiliary lip 43 is structured such as to seal the internal sealed oil between the rod guide 3 and the washer 41. The outer peripheral lip 46 is structured such as to seal the internal sealed oil between the cylinder 2 and the washer 41. The dust lip 45 is slidably brought into close contact with the outer peripheral surface 1a of the rod 1, thereby preventing a dust and a muddy water in the atmosphere B side from making an intrusion into the sealed space A through the outer periphery of the rod 1.

In this case, the main lip 42 is directed to the sealed space A side. Accordingly, if a hydraulic

pressure in the sealed space A is increased in accordance that a piston (not shown) in an inner portion of the hydraulic shock absorber moves in an axial direction together with the rod 1, the hydraulic pressure acts on the main lip 42 in such a manner as to increase the tension force applied to the outer peripheral surface 1a of the rod 1. However, since the main lip 42 is backed up from the inner peripheral side and the atmosphere B side by the backup ring 44 made of the synthetic resin material, it is possible to effectively suppress an increase of the tension force of the main lip 42 with respect to the outer peripheral surface 1a of the rod 1. As a result, it is possible to sufficiently improve a pressure tightness of the main lip 42 without making the inner diameter of the washer 41 close to the outer diameter of the rod 1.

Further, the sealing apparatus 4 is structured such that the main lip 42, the auxiliary lip 43, the dust lip 45 and the outer peripheral lip 46 are integrally bonded by vulcanization to the washer 41, and the backup ring 44 is previously held between the main lip 42 and the washer 41, the number of parts is reduced, and it is possible to easily install it at a time of assembling the hydraulic shock absorber.

Next, Fig. 2 is a half sectional view showing a

second embodiment of a sealing device for a reciprocating shaft in accordance with the present invention by cutting along a plane passing through an axis together with a part of a hydraulic shock absorber.

The sealing device 4 in accordance with the second embodiment of the present invention is interposed between the rod 1 and an end portion of the cylinder 2, and is provided with the washer 41, the main lip 42 closely fitted to an inner peripheral surface of a main lip holding concave portion 41c formed in the sealed space A side in the inner peripheral portion 41a of the washer 41 and slidably brought into close contact with the outer peripheral surface 1a of the rod 1, the auxiliary lip 43 integrally formed in the outer peripheral side thereof, - - - - the main lip 42 - - - -

The outer peripheral lip 46 directed to the sealed space A side is brought into close contact with the outer peripheral step portion 32 formed in the outer periphery of the contact portion with the washer 41 in the rod guide 3 so as to be continuous in the circumferential direction, and the inner surface of the cylinder 2 with the proper fastening margin. The backup ring 44 is molded with the low-friction synthetic resin material such as the PTFE or the like, has the cut portion 44a at one position in the circumferential direction, and is fitted to the portion between the supported surface 42e formed in the inner peripheral portion of the main lip 42 and the rising surface in the diametrical direction of the main lip holding concave portion 41c in the washer 41.

In the sealing device 4 in accordance with the second embodiment structured as mentioned above, the main lip 42 is slidably brought into close contact with the outer peripheral surface 1a of the rod 1, thereby preventing the internal sealed oil in the sealed space A from leaking to the atmosphere B side through the outer periphery of the rod 1. The auxiliary lip 43 is structured such as to fit and fix the main lip 42 to the main lip holding concave portion 41c in the washer 41 in the sealing manner, and seal the internal sealed

oil between the rod guide 3 and the washer 41. The outer peripheral lip 46 is structured such as to seal the internal sealed oil between the cylinder 2 and the washer 41. The dust lip 45 is slidably brought into close contact with the outer peripheral surface 1a of the rod 1, thereby preventing the dust and the muddy water in the atmosphere B side from making an intrusion into the sealed space A through the outer periphery of the rod 1.

Since the main lip 42 is backed up from the inner peripheral side and the atmosphere B side by the backup ring 44 made of the synthetic resin material, it is possible to effectively suppress an increase of the tension force of the main lip 42 with respect to the outer peripheral surface 1a of the rod 1 at a time when the hydraulic pressure in the sealed space A is increased. As a result, it is possible to sufficiently improve a pressure tightness of the main lip 42 without making the inner diameter of the washer 41 close to the outer diameter of the rod 1.

Further, since the sealing apparatus 4 is structured such that the dust lip 45 and the outer peripheral lip 46 are integrally bonded by vulcanization to the washer 41, the main lip 42 (and the auxiliary lip 43 integrally formed therewith) are

previously held to the main lip holding concave portion 41c in the washer 41 via the auxiliary lip 43, and the backup ring 44 is fitted to the portion between the main lip 42 and the main lip holding concave portion 41c so as to be held, it is possible to easily install it at a time of assembling the hydraulic shock absorber.

Next, Fig. 3 is a half sectional view showing a third embodiment of a sealing device for a reciprocating shaft in accordance with the present invention by cutting along a plane passing through an axis together with a part of a hydraulic shock absorber.

The sealing device 4 in accordance with the third embodiment of the present invention is structured such that the auxiliary lip 43 in the second embodiment mentioned above is abolished, and the base portion 42a of the main lip 42 is pressure-inserted - - - the main lip holding concave portion 41c in the washer 41, as shown in Fig. 3.

the outer peripheral surface 1a of the rod 1, thereby preventing the internal sealed oil in the sealed space A from leaking to the atmosphere B side through the outer periphery of the rod 1. The outer peripheral lip 46 is structured such as to seal the internal sealed oil between the cylinder 2 and the washer 41. The dust lip 45 is slidably brought into close contact with the outer peripheral surface 1a of the rod 1, thereby preventing the dust and the muddy water in the atmosphere B side from making an intrusion into the sealed space A through the outer periphery of the rod 1.

Since the main lip 42 is backed up from the inner peripheral side and the atmosphere B side by the backup ring 44 made of the synthetic resin material, it is possible to effectively suppress an increase of the tension force of the main lip 42 with respect to the outer peripheral surface 1a of the rod 1 at a time when the hydraulic pressure in the sealed space A is increased. As a result, it is possible to sufficiently improve a pressure tightness of the main lip 42 without making the inner diameter of the auxiliary washer 47 close to the outer diameter of the rod 1.

Further, since the sealing apparatus 4 is structured such that the molded body constituted by the washer 41 and the dust lip 45, and the molded body



constituted by the auxiliary washer 47, the main lip 42 and the outer peripheral lip 46 are integrated in accordance with the pressure insertion and fitting between the washer 41 and the auxiliary washer 47, and the backup ring 44 is fitted to the portion between the main lip 42 and the washer 41 so as to be held, it is possible to easily install it at a time of assembling the hydraulic shock absorber.

#### Industrial Applicability

As mentioned above, the present invention can be preferably carried out in the sealing device for the reciprocating shaft, which seals the reciprocating shaft of the hydraulic shock absorber of the vehicle and the like.

What is claimed is:

1. (Amended) A sealing device (4) for a reciprocating shaft, the sealing device being interposed between a shaft (1) reciprocating in an axial direction and an outer peripheral member (2) surrounding an outer periphery thereof, comprising a washer (41);

a main lip (42) integrally bonded to a sealed space (A) side of the washer (41) and slidably brought into close contact with an outer peripheral surface (1a) of said shaft (1);

an auxiliary lip (43) integrally formed in an outer peripheral side thereof; a backup ring (44) fitted to a portion between an atmosphere (B) side of the slidable surface (42C) of said main lip (42) and an inner peripheral portion (41a) of said washer (41) and bearing said main lip (42) from the atmosphere (B) side and the inner peripheral side;

a dust lip (45) integrally bonded to the atmosphere (B) side of said washer (41) and slidably brought into close contact with the outer peripheral surface (1a) of said shaft (1); and

an outer peripheral lip (46) integrally bonded to the outer peripheral portion (41b) of said washer (41) and brought into close contact with said outer

peripheral member (2),

wherein said auxiliary lip (43) is brought into close contact with an inner peripheral surface of an inner peripheral step portion (31) formed in an inner periphery of a contact portion with said washer (41) in a rod guide (3) fixed to said outer peripheral member (2) and having an inner peripheral surface closely faced to an outer peripheral surface of said shaft (1) so as to be continuous in a circumferential direction, with a proper fastening margin.

2. (Amended) A sealing device (4) for a reciprocating shaft, the sealing device being interposed between a shaft (1) reciprocating in an axial direction and an outer peripheral member (2) surrounding an outer periphery thereof, comprising  
a washer (41);

a main lip (42) closely fitted to a main lip holding concave portion (41c) formed in a sealed space (A) side in an inner peripheral portion (41a) of the washer (41) so as to be continuous in a circumferential direction and slidably brought into close contact with an outer peripheral surface (1a) of said shaft (1);

a backup ring (44) fitted to a portion between an atmosphere (B) side of the slidable surface (42c) of the main lip (42) and a rising surface of said main

lip holding concave portion (41c) and bearing said main lip (42) from the atmosphere (B) side and the inner peripheral side;

a dust lip (45) integrally bonded to the atmosphere (B) side of said washer (41) and slidably brought into close contact with the outer peripheral surface (1a) of said shaft (1); and

an outer peripheral lip (46) integrally bonded to the outer peripheral portion (1a) of said washer (41) and brought into close contact with said outer peripheral member (2).

3. (Amended) A sealing device (4) for a reciprocating shaft, the sealing device being interposed between a shaft (1) reciprocating in an axial direction and an outer peripheral member (2) surrounding an outer periphery thereof, comprising

a washer (41);

an auxiliary washer (47) arranged in a sealed space (A) side of said washer (41) in a state of being brought into contact with a rod guide (3) fixed to said outer peripheral member (2) and having an inner peripheral surface closely faced to an outer peripheral surface of said shaft (1), and having an outer peripheral portion pressure-inserted and fitted to said washer (41);

a main lip (42) integrally bonded to a sealed space

(A) side in an inner peripheral portion of the auxiliary washer (47) and slidably brought into close contact with an outer peripheral surface (1a) of said shaft (1);

an outer peripheral lip (46) integrally bonded to an outer peripheral portion of said auxiliary washer (47) and brought into close contact with said outer peripheral member (2);

a backup ring (44) fitted to a portion between an atmosphere (B) side of the slidable surface (42c) of said main lip (42) and an inner peripheral portion (41a) of said washer (41) and bearing said main lip (42) from the atmosphere (B) side and the inner peripheral side; and

a dust lip (45) integrally bonded to the atmosphere (B) side of said washer (41) and slidably brought -  
- - - the outer peripheral surface (1a) of said shaft (1).